

PROGRAMS FOR THE MAINTENANCE CONTROL
OF INJURIOUS FOREST INSECTS
ON SOME RECREATIONAL AREAS
IN THE CLEVELAND NATIONAL FOREST

by

K. A. SALMAN
Agent, Bureau of Entomology

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R.F. (4)
FCC
KAS
4/31
C.W. Cotton
H. Harriss
L.A. Bennett

Berkeley, California
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PROGRAMS FOR THE MAINTENANCE CONTROL OF INJURIOUS FOREST INSECTS
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Introduction

The small and large stands of conifers within the Cleveland National Forest already play an important role in providing relaxation and pleasure for the urban population of the more southern portions of California. The conifer timber cover is an essential factor in making these areas suitable for recreational purposes, and because of this the values of the stands have risen far above the actual value of the timber. Any losses caused by the attack of injurious forest insects are thus much greater than the value of similar losses in commercial timbered areas in which the market value of the timber destroyed is the only loss.

The present amount of use of these timbered areas has brought about insect losses, due to man's activities, that are probably far in excess of what would normally occur. It is logical to expect that a greater number of people will utilize the areas favorable for recreational purposes in the future, and thus we may expect that this more intensive utilization will bring about greater insect-caused losses. As the majority of these conifer areas are on "borderline" sites, in which environmental conditions cannot be considered exactly favorable for the trees, the possibility of abnormal natural insect losses are much greater than in areas enjoying more favorable environmental conditions.

Because of the factors concerned with use and those of environment it is felt that, if present recreational values are to be maintained and future conditions provided for, it will be necessary to formulate and carry out definite management plans for recreational areas with the idea of maintaining the population of injurious forest insects at a low level, and thus reduce insect-caused losses to a minimum. As each recreational area presents a different set of conditions, it is felt that each situation must be considered separately, and that a blanket program covering all recreational areas is not possible. Accordingly the accompanying plans are presented for maintenance control of injurious forest insects in certain specific recreational areas. The accompanying map shows roughly the location and extent of these areas.

Reasons for Maintenance Control

Insects Involved

The greater portion of the losses in the areas considered in this report are due to the western pine bark beetle (Dendroctonus brevicomis Lec.) (Fig. 1), which attacks western yellow pine and Coulter pine; the engraver beetles of the genus Ips (Fig. 2), that attack western yellow pine, Coulter pine and Jeffrey pine; and flathead borers, Melanophila sp. (Fig. 3), that attack all species of pine in the areas. The mountain

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pine beetle, Dendroctonus monticolae Hopk., (Fig. 4) causes some slight damage to western yellow pine, and the Jeffrey pine bark beetle, Dendroctonus jeffreyi Hopk. (Fig. 5), may be present in Jeffrey pine in the areas concerned, although no damage caused by this beetle has as yet been found. The fir engraver beetle, Scolytus ventralis Lec. (Fig. 6), causes the greater part of the injury to white fir, although this species of tree is not abundant in many of the areas discussed.

The western pine bark beetle causes the greater portion of the damage, and no measure of control now known has proven sufficiently effective to eradicate it in a timbered area. It is believed, however, that eradication may be possible under special conditions, such as those occurring in some small, completely-isolated areas. If eradication were possible, there is always the possibility that the insects will, either through their own efforts or by the aid of man, be reintroduced. The logical conclusion, then, is not to attempt eradication, but to limit the population of the various injurious insects by means of control work to a relatively innocuous minimum.

Tree Susceptibility

The trees of a forested area form a community made up of individuals that usually differ in age, size, vigor and general health, and that exhibit various degrees of resistance or susceptibility to insect attack. These attributes of individual trees vary from year to year, and are particularly affected by environmental conditions of climate, soil, light etc. Each year some trees will become more susceptible to insect attack than previously. Injuries to trees by man will cause an increase in the number of weakened trees, so that any measures designed to reduce the insect population and the damage caused by it to a minimum should include preventive as well as control measures. If it were possible to select and destroy or utilize those trees that are susceptible and would be attacked were they allowed to remain in the stand, it might be possible to keep the insect population at a low ebb without allowing the insects to attack successfully and kill some trees. This however appears to be impossible, as there is no accurate method known of selecting trees that will be attacked in the future.

Maintenance Control

Accordingly, probably the best practices to employ in reducing losses are those of applying approved methods of control to those trees containing broods at a time when the insects can be destroyed; by making these operations annual and part of the regular management of the recreational areas, so that the insect population will not have a chance to build up to aggressive proportions; and by employing care in road and building construction and preventing abuse of trees that might tend to weaken them.

These practices, which should be employed by those in charge of or owning areas used for recreational purposes, constitute maintenance control. The method consists of planned treatments, based on a realization that the timber cover is composed of living organisms; that care in

use will lessen the possibility of insect damage; that climatic or other environmental conditions provide opportunities for recurrent and always imminent insect attacks on susceptible trees; and that climatic and other environmental conditions may at any time allow the insect population to become so large and aggressive (by building up through lack of care and presence of favorable conditions) as to destroy large percentages of the recreational values in an area.

Administration of Maintenance Control

The administration of maintenance control programs is dependent on the owners or managers of recreational areas for its efficiency and production of results. It must be recognized that the program is annual and continuous, and although, after conditions are surveyed in any single year and a decision is rendered against attempting any control work that season because of a small amount of loss, there is no basis for reasoning that no further control work will be necessary in future years. The administrators of an area must always be alive to the necessity of an annual survey of conditions and of initiating control work if values destroyed warrant it.

Management

When an area is under a single ownership or management, the problem is simple, but complications result when many owners are involved. In the areas considered in this report four different conditions are involved, as follows:

1. Entire area under Government ownership; special use leases involved;
2. Entire area under private ownership; several owners involved;
3. Area under private and Government ownership; no leases involved;
4. Area under private and Government ownership; leases involved.

The Forest Service has already made provision for maintenance control in recreational areas containing special use leases and under their administration by requiring the ranger in charge to be on the watch for the appearance of beetle infestations on areas especially devoted to recreational use and to notify the permittees concerning the presence of the beetles. In addition it has been stated--S(L) Insect Control, Dec. 8, 1930--that the following clause will be incorporated in all special use permits: "Whenever requested to do so by the forest officer in charge the permittee shall be responsible for the removal of any diseased or insect-infested trees on the area held under permit, the work to be done within the time limits specified and in accordance with instructions issued by the forest officer." These provisions meet the situations on forest lands under lease for recreational purposes, and depend on the forest officer in charge for the conduct of the maintenance control program.

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In areas under private ownership, if several owners are involved it will be necessary to set up some community organization that will direct the formulation of the program, the continuance of the work and the provision of the necessary means for carrying on the work. When such an organization exists, it will probably be necessary to seek expert advice in formulating a maintenance control plan. Success in this type of work depends upon cooperation among the owners and realization of a community responsibility.

When private and Government ownerships are involved and no special use leases are concerned, there will of necessity be cooperative effort, and a plan should be worked out that will fit the needs of the particular situation.

When Government and private ownerships are concerned and special use leases are in force on the Government holdings, cooperation should be secured between the Government and the private land owners. The special use lease insect control clause may be utilized in clearing leased lands of insect infestations. As in the preceding case, details of cooperation should be worked out to fit the situation.

Methods

Any area that is considered as a control unit must have conditions that will insure effective results from the work. Thus there must be isolation from other stands of timber or barriers, of either type or topography, that will prevent the spread of insects into the area from nearby forests. Where effective type isolation is lacking, control work should be extended for at least a mile outside of the area to be protected in order to set up a barrier zone. It may be that none of these conditions is necessary if the only insects concerned are the relatively minor flathead borers or engraver beetles that may possibly have limited tendencies to spread en masse or to continue a vigorous attack.

There is no set rule by which to judge the necessity of control in any given year. If trees that cannot be spared are being attacked by beetles, there is assuredly no doubt as to the necessity of control. The number of trees that may be spared with no serious danger to the stand depends upon the particular stand concerned and upon its use. It must be remembered, however, that although a few trees may be spared each year in an area, those trees if left untouched may develop successful broods that will be capable of destroying several times the original number of trees the following year, or even in the same season if two or more broods are produced in a season by the insect species in question. Once attacked, there is nothing that can be done to save those trees, and the only alternative is destruction of the trees and the broods they contain.

Survey and Control Methods

The methods used are given in detail in the mimeographed "Manual of Bark Beetle Control in Western Pine Forests", March 1927, and in Bulletin 7, California Department of Natural Resources, "Insect Enemies of California Pines and Their Control" (1929), both papers by F.P. Keen.

In general, survey work consists of a thorough examination of the entire stand, preferably in the fall of the year, and a "spotting" or locating of trees containing active broods of beetles. Placing tree locations on a large-scale map and numbering and listing trees is an aid to memory and an insurance against missing trees at the time of control. Any method of cruising that will enable the spotter to cover the entire area may be used.

Trees to be Treated

Generally speaking, trees that contain broods in or under the bark within reach from the ground should be treated. Trees that are fading or freshly faded (Fig. 7) in the top 50% of the crown should be treated. Trees that are not faded, but because of the heavy attack--shown by the abundance of pitch tubes (Fig. 8) over a large portion of the bark of the trunk--appear sure to succumb, should be marked for control treatment. The felling of snags and trees from which the beetles have emerged (Fig. 9) is of no value, as no injurious insects will be killed. The felling of trees in which only a small part of the top has faded or is dead (Fig. 10) is not practical, as the number of insects destroyed will not be worth the work, and in addition the tree has a fairly even chance of living and becoming a "spike-top".

Control

Control methods are of one order. They consist of felling the trees containing brood at a time when it is possible to burn them, and the peeling and entire destruction of the bark. The injurious insects will be found in the bark or between it and the wood, and destruction of those insects in the bark or exposure of those between the bark and wood will destroy the brood. If the tree can be utilized as firewood or for any other purpose, the bark may be peeled, piled and burned (Fig. 11); but if it is more economical of time and labor to peel the top portion of the trunk as it lies on the ground, cut the limbs and pile both branches and bark against the trunk, setting fire to the whole when fire conditions are not hazardous (Fig. 12). The essential point in control is to destroy the brood, and in most cases burning the bark will be necessary (Figs. 13,14,15).

Prevention

Engraver beetles and flathead borers attack unpeeled logs and branches. They and other beetles attack weakened trees. Accordingly it is essential that logs for log cabins be barked before construction and the bark burned, and that as few trees as possible be injured by abuse in throwing oil or chemicals around the roots or by scarring them or hacking the trunk. It is also essential that right-of-way clearing be followed within two weeks at least by utilization of logs and burning of limbs, or by burning of both logs and slash, if no utilization is possible.

Conditions in Areas Examined

Corte Madera

Acreage: Timber extends over about 3 sections of land

Ownership: Approximately 60% private, 40% Government

Type: Coulter pine-Jeffrey pine

Infestation: Western pine beetle, flathead borers, engraver beetles in Coulter pine; flatheads and engravers in Jeffrey pine.

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In the spring of 1930 spotting and maintenance control work on the 1929 winter generation was started by the Corte Madera Land Company, in cooperation with the Forest Service. It was conducted on an annual basis, and no definite plans were made for future work. The 1929 loss of approximately 48 trees dropped to 12 trees in 1930, after one season of control work, and the 1930 winter brood trees were treated during the winter of 1930-31 by the Corte Madera Land Company. With this start in maintenance control some thought must be given to the future. The Forest Service has no values to be protected other than the slight value of the timber. The Corte Madera Land Company, however, has valuable recreational developments to be protected; but protection must include treatment of timber on both private and Government land if it is to be effective. Obviously some agreement must be reached between the private owners involved and Government administrative officers as to cooperation on the survey or control work and for the continuation of the project.

It is felt that the values involved in the area justify continued care, and that such protection will prevent the possibility of outbreaks in the future. It is suggested that, if a basis of action satisfactory to private owners and Government administrators can be formulated, provisions be made to cruise the area annually during the dormant (winter) season, and to apply control measures to the trees found to contain brood.

Pine Creek

Acreage: Not over 640 acres
Ownership: 100% Government; special-use lots involved
Type: Scattered western yellow pine
Infestation: Western pine beetle

The stand is well isolated except on the southern boundary at the entrance to Pine Valley. Insect losses are relatively light; but as the stand is sparse and scattered, few trees can be spared if the area is to retain its value.

It is recommended that maintenance control be initiated in this area. Administration of this would consist of annual winter surveys of the situation by the ranger in charge and marking of the brood trees. Notification of infestation would be sent to the lessees under the insect-control clause, and control work would be done by them on the lands allotted them under their permits. It would be necessary for the Forest Service to conduct control measures on Government property not under lease and on other portions of the valley outside the leased area. As the area is small this would require but a limited amount of labor and could probably be handled by the regular forest force.

Pine Valley

Acreage: Approximately 960 acres
Ownership: Areas involved in private ownership
Type: Western yellow pine in scattered stands
Infestation: Western pine beetle

Insect losses in Pine Valley from the western pine beetle are somewhat heavier than in the adjoining Pine Creek area. The stand is sparse, and if this is to continue as a recreational area few trees can be spared. The valley is well isolated from other stands of timber; and if sufficient interest is shown by the several owners in protecting the recreational values afforded by the conifer stand in the valley, a program of maintenance control could be initiated and maintained with but little expense.

Laguna

Acreage: About $3\frac{1}{2}$ sections (excluding areas outside those considered in this program)
 Ownership: About 95% Government, 5% private; special-use lots and campgrounds involved
 Type: Jeffrey pine-Coulter pine
 Infestation: Flathead borers and engraver beetles in Jeffrey and Coulter pine

The timbered area is extensive and includes much private land used only for grazing purposes (Campbell Estate). This makes it impossible to consider that type of private land in any maintenance-control program because of the expense that would be incurred and the low values involved. If it were desired to conduct a maintenance-control program against the western and Jeffrey pine beetles--were they ever to invade the area--it would be absolutely necessary to include those private lands. Under the present conditions of flathead and engraver beetle infestation, however, it would appear possible and desirable to conduct control operations in, and in the areas surrounding, the Government special-use lots and campgrounds and in the privately-owned recreational developments. These control measures probably would not result in complete control, because of the incomplete isolation of these areas. They should be carried on as sanitation measures and as a method of protection for the trees in the immediate vicinity; for it has been noted that both flathead and engraver beetles show a tendency to attack adjacent trees upon emergence from infested trees.

From the standpoint of stand sanitation it is recommended that maintenance control be initiated in the special-use lot areas and the public camp areas, that cooperation be secured from the two private recreational developments concerned, and that the Forest Service enlarge the operations to include Government land surrounding these recreational centers, in order to provide as extensive a protective barrier as possible, to prevent reinestation from outside sources. Preventive measures, as outlined in this report, should be initiated, and their administration may possibly fit in with the duties of the forest officer making the annual inspection of the special use areas.

It is to be expected that much of the work connected with this project will be done by the field force on the ground and by the permittees and private land owners. It will probably be necessary, however, to allot a small sum of money (tentatively estimated at \$100) for the employment of supplementary labor when necessary.

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Cuyamaca

Acreage: There are approximately 57 sections of land in the grant, although much of this carries no pine timber; approx. one section of land is within the resort area

Ownership: 100% private

Type: Coulter pine predominates in the resort area; the stand in the grant is a mixed conifer type

Infestation: Western pine beetle

The general infestation throughout the Cuyamaca Grant is moderately heavy but has not yet reached epidemic proportions. Small portions of the pine stands on the grant show heavy epidemic infestations at the present time.

Although the infestation is general throughout the area and although, because of conditions unfavorable for tree growth, it may become epidemic, it is not thought wise to attempt control activities in any portion of the area unless that portion is sufficiently isolated to provide some obstacle to an influx of beetles from outside areas, or unless the values at stake warrant the initiation of control measures. As most of the Cuyamaca Grant is not used for any purpose that gives the pine timber a higher value than its actual worth as wood or timber, it is unnecessary to consider control over the entire grant. The one area in which the recreational values might warrant control work is that near Cuyamaca Lake. Here, however, there are no natural barriers that would prevent reinfestation, and because of this it would be necessary to practice insect control over a much larger area than it is wished to protect. Under present conditions there appears to be no necessity for considering any maintenance control program for the Cuyamaca Grant; and unless the owners consider the timber cover of sufficient aesthetic value, the timber values would scarcely support efforts at control, even under epidemic conditions.

Julian (Pine Hills, Kentwood in the Pines etc.)

Acreage: Eight or more sections of land, not all of which carry lumber, are involved in this area

Ownership: 100% private

Type: Coulter pine, chiefly immature stands

Infestation: Kentwood--Engraver beetle and endemic western pine beetle infestation in Coulter pine
North of Julian--near Whispering Pines and in Pine Hills--western pine beetle in spotted epidemic infestations

The recreational areas in the vicinity of Julian may all be classed together. The uses to which the various areas are put under the several private ownerships offer some difficulty in arranging for any comprehensive treatment of the present infestations or preparing any program for future maintenance control. No one recreational area forms a complete unit providing isolation enough to make control work feasible in that area alone. In addition, another difficulty is introduced by the fact that the recreational areas are bounded by other areas used for grazing cattle or some other purpose. No comprehensive program presents

itself that would meet the requirements of the situation and yet would not infringe on the needs of the various owners when the values they have at stake are considered.

Some protection of the recreational areas might be secured by the owners of individual areas by following out their own sanitation program, based largely on the benefits to be derived when considered from that point of view.

In areas showing infestation of the type that prevails at the present time at Kentwood, in which engraver beetles are causing the greater portion of the injury to living trees, sanitation methods, consisting of the barking of felled trees and destruction of bark and slash soon after the trees are cut, would effectually stop the breeding-up of engraver beetles, and thus the subsequent injury to living trees. The effects of this sanitation type of control program, however, would probably not be of great value in protecting the timber on the recreational areas if there should occur a widespread epidemic infestation of the western pine beetle.

Palomar Mountain

Acreage: Approximately 16 sections

Ownership: Approx. 85% private, 15% Government

Type: Coulter pine and mixed conifer

Infestation: Western pine beetle in Coulter and western yellow pine stands; the fir engraver beetle is causing some loss in white fir

This area, which includes the timbered portions of Will Valley, Dyche Valley, French Valley, Doane Valley, Morgan Hill and the recreational center near Palomar, also presents no one set of conditions that would appear to favor a recommendation for insect control. The ownership is largely private, but some Forest Service timbered lands are concerned. In Will, Dyche and Doane Valleys, on Devil's Peak north of Morgan Hill, and on the southern exposures and lower slopes of Morgan Hill, the infestation is largely one of the western pine beetle in yellow pine or Coulter pine. The infestation in Dyche and Will Valleys and possibly in and around Doane Valley and Devil's Peak, is the only one which might warrant attention at the present time, if the amount of loss and tendencies of the infestation are considered. These infestations, however, are either on private land used for grazing and other purposes, or are on Government land having low value at the present time. At any rate, none of the present infestations is on lands or in stands in which the values at stake warrant control, either sporadic or maintenance. On the Government holdings inaccessibility and poor quality of timber give low intrinsic value to the stands, and no recreational values are involved. On private lands the stands apparently have a much greater intrinsic value, but not great enough to warrant control programs unless extrinsic values are involved. If conditions should increase the values at stake, or if private owners wished to conduct control measures regardless of the economics of the situation, it would be possible to outline two distinct control units, one for the pine timber in Dyche and Will Valleys and the other covering Doane Valley and vicinity, each rather clearly set off from surrounding timber of the same type by topographic or type barriers.

The stands in the vicinity of Palomar are the only ones in which the values involved would apparently justify the initiation of control; but as these stands are of mixed conifer species and losses at the present time are extremely light, there is no real need for any formal control program, and sanitation measures carried out by the owners on their own initiative should suffice.

As stated in my memorandum of October 1930, the Dyche Valley infestation is one of the worst I have seen; but in this case, as with the other infestations on Palomar Mountain, the economics of the situation govern, and thus make control work unnecessary. An analysis of the Dyche Valley infestation, which possesses several unusual features, will be made in a separate memorandum.

Summary of Recommendations

Maintenance control, as applied to recreational areas, is based on the assumption that use and protection must go on together if the capital stock of an area, which is the forest cover, is not depleted. Maintenance control cannot be successfully carried out in all areas. The economics of each situation must decide as to its feasibility, and apparently the two basic factors are the values to be protected and the results to be expected from the type of protection possible.

Conditions in the following recreational areas have been considered and the following recommendations are made:

Corte Madera

The values at stake undoubtedly warrant continued protection of the timber cover. It is recommended that control work be continued and that a permanent plan for the project be drawn up that will be satisfactory to those concerned.

Pine Creek

As the sparse pine stand is essential for the continued recreational value of this area, it is recommended that the Forest Service apply the administrative regulations now available in covering the situation.

Pine Valley

In this area it is conceivable that the continued loss of trees through the attacks of forest insects will within a short time cause a marked decrease in the recreational values of the area. A maintenance-control program under the administration of the private owners involved would help in retaining those values.

Laguna Recreational Area

The extent of the Jeffrey pine stand and the presence of a large acreage of forest used for grazing purposes by private owners make insect control plans for this area difficult to prepare. However, there is a distinct need that some attention be given to protection of the recreational centers. Under the conditions of the present infestation by flathead borers and engraver beetles it appears that sanitation measures in and around the recreational centers would afford that protection. Cooperation among private owners, special use permittees and the Forest Service will be essential.

Cuyamaca

The economics of the situation in the Cuyamaca Grant do not warrant control, even though the present infestation is to be classed as heavy and increasing in intensity. The values to be protected in the Grant are too low to bear the burden and in the Cuyamaca Resort--the one area in which maintenance control may be justified,--the results to be expected from a moderate expenditure of energy would not be satisfactory. It would be necessary to maintain too great an area in order to protect effectively the values of the relatively small resort area.

Julian

Largely due to the multiplicity of ownerships and uses of the land carrying pine forest cover in these areas, it appears impossible to provide a blanket control policy that will be advantageous to all the owners. Accordingly sanitation measures on the individual resort areas in which the values are sufficiently high are recommended. Preventive and sanitation measures are most needed in the present engraver beetle infestation in Kentwood. No program appears possible that would protect the entire area from an epidemic western pine beetle infestation unless full cooperation could be secured from all the individual owners --a feature that would probably prove detrimental to the interests of some of those concerned.

Palomar Mountain

Conditions in this area also do not favor the preparation of a complete control program. The low values concerned are largely responsible for this. The present type of infestation in the recreational areas on the Mountain may be handled by sanitation measures carried on by the individual owners.



Fig. 1. Galleries of western pine beetle (Dendroctonus brevicomis Lec.) as revealed on sapwood after removal of bark.
(Photo #2447)



Fig. 2. Galleries of engraver beetles (Ips confusus Lec. left, Ips oregoni Eich. right) as they appear when bark is removed.

(Photo #7431)

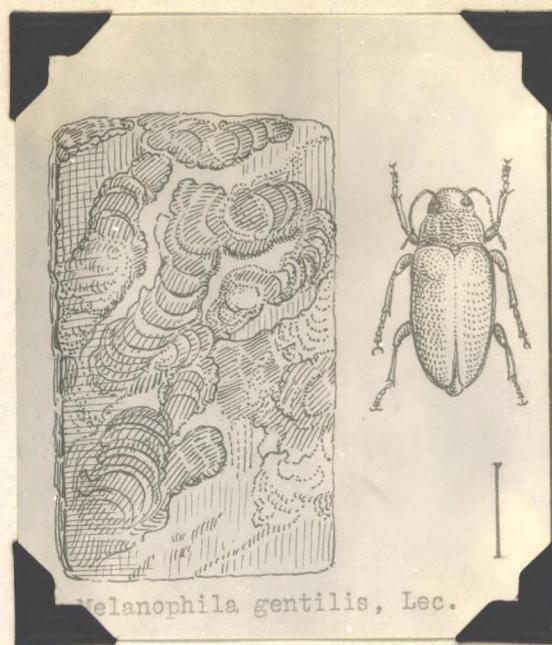


Fig. 3. Drawing of adult and work done by the pine flathead borer (Melanophila gentilis Lec.) in the inner bark of pine trees. (Photo #7634)



Fig. 4. Work of the mountain pine beetle (Dendroctonus monticolae Hopk.) on a felled log, as seen when bark is removed. (Photo 2329)

Fig. 5. Egg and larval galleries on inner bark of Jeffrey pine, caused by Jeffrey pine beetle (Dendroctonus jeffreyi Hopk.). (Photo #7334)



Fig. 6. Brood and larval galleries engraved on sapwood of white fir by the fir engraver beetle (Scolytus ventralis Lec.) (Photo 7430)



Fig. 7. Typical insect-killed western yellow pine as it appears in forest when fading or freshly faded. Foliage is light silvery-green and fading of entire tree indicates a strong attack; such trees should be treated.

(Photo #2430)



Fig. 8. Showing pitch tubes on outer surface of bark of western yellow pine. These are often abundant and visible on trees attacked by the western pine beetle. Arrows point to individual tubes.

(Photo #2569)

2569

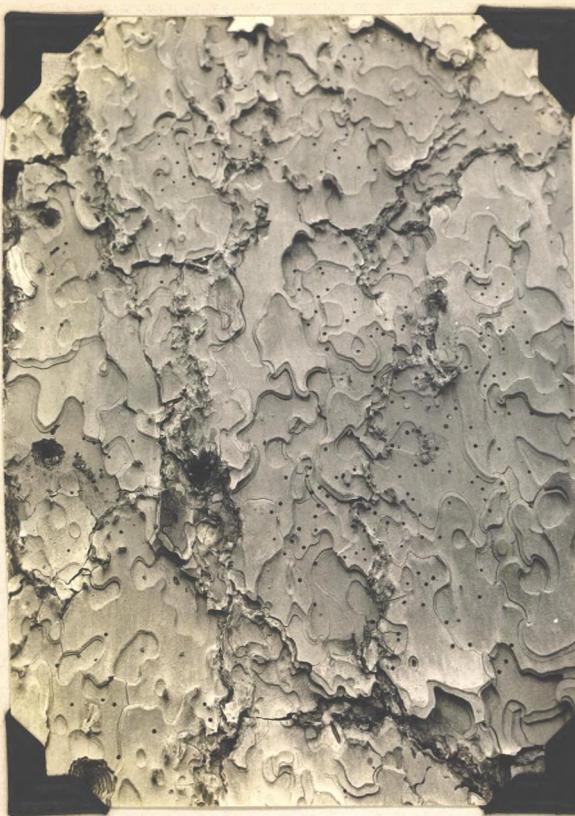


Fig. 9. Appearance of bark of western yellow pine from which brood of western pine beetles has emerged. Numerous emergence holes indicate adults have left tree and probably few beetles would be destroyed if tree were treated.

(Photo #2447)



Fig. 10. Trees in which a small portion of the top is fading, due to insect attack, should not be felled. Top-killed tree on right has about 50% of top killed and should be treated; smaller trees to left of it have but few feet of top killed and control measures should not be applied to them.

(Photo #7421)



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Fig. 11. Control and utilization of wood. Note that bark has been peeled and bark and branches burned in piles some distance from trunk.
(Photo 7425)

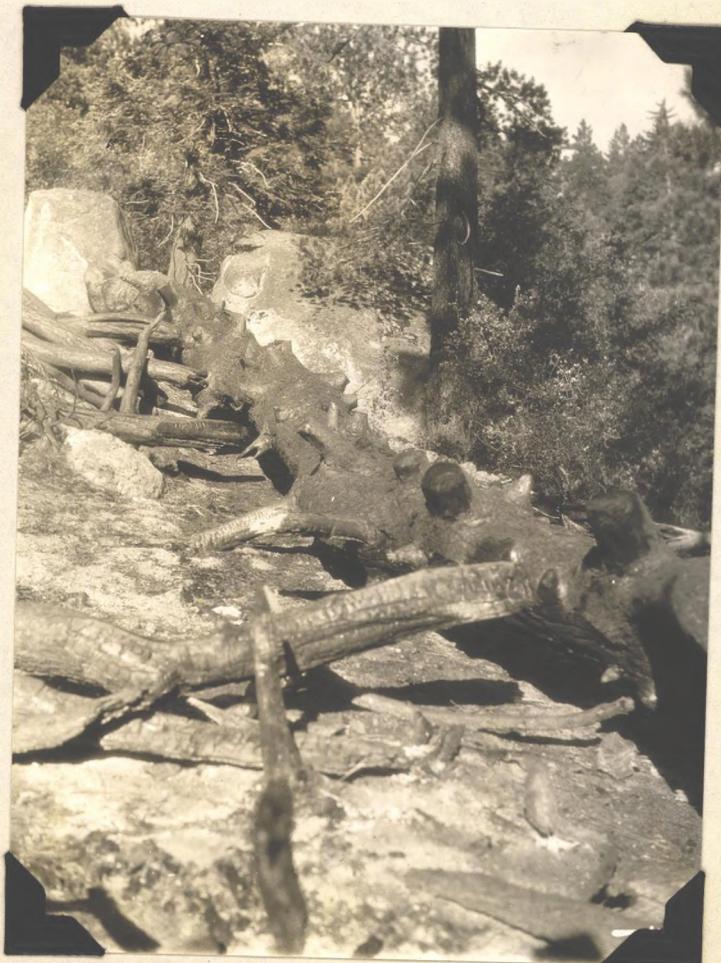


Fig. 12. Control without utilization. Bark is peeled from upper half of trunk, limbs are cut and piled against trunk and entire tree charred.



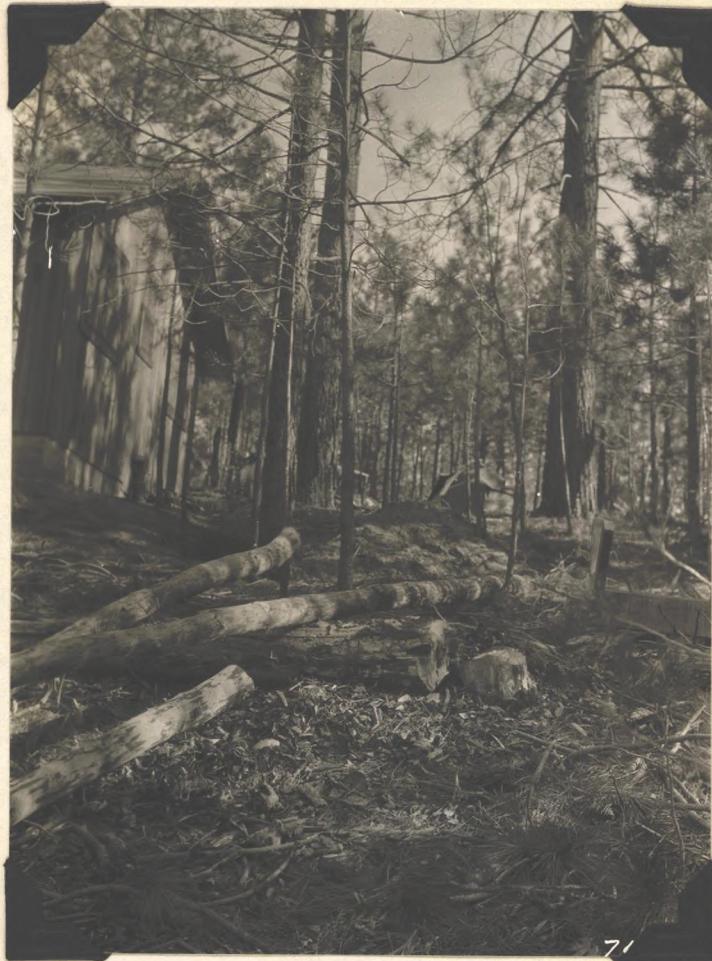
Fig. 13. Cause of an infestation and poor control. The pile of green unpeeled logs in foreground produced a heavy brood of western pine beetles and engraver beetles that attacked surrounding living trees. The tree lying across the pile was attacked, and was felled but not treated; no brood was destroyed and the work was wasted. The bark of this tree should have been burned.

(Photo #7427a)



Fig. 14. The tree shown in Fig. 13 is photographed here to show the heavy attack it sustained. Pitch tubes may be seen in large numbers, indicating the heavy brood that may emerge from unpeeled logs left lying in the shade.

(Photo #7427b)



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Fig. 15. The three small trees in this picture were attacked by brood emerging from trees cut in connection with the building of the cabin shown in the photo. The attacked trees were felled and peeled but the bark was not burned. Trees of this size should be burned without peeling, as the value of the firewood salvaged is not high enough to warrant the labor of peeling.

(Photo #7426)

